ORIGINAL ARTICLE

# Hearing Aids Versus Cochlear Implants: Aiding the Development of Self-Concept for Promoting Linguistic Competencies

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**ABSTRACT**

**Objective:** The objective of the study was to determine the impact of hearing loss on the self concept of hearing impaired students and to ascertain the impact of hearing aids and cochlear implants on their self concept.

**Study Design:** It was a descriptive, cross-sectional study.

**Place and Duration of Study:** The study was conducted in Sir Syed School and College of Special Education, Rawalpindi with permission from the concerned authority. It took the researcher six weeks from 12th Sep 2016 to 21st Oct 2016 to collect data from hearing impaired students.

**Materials and Methods:** An aggregate of 233 students was the sample of this study of which 103 were students using hearing devices and 120 students were using normal hearing controls. Special arrangements were made to collect the data. The hearing impaired students could choose between two versions of the questionnaire. The first version was exclusively composed of things, while in the second; everything was displayed in written text with sign language video clip appearing at the top corner of the screen by using Master Writer 3.0 software, whereas, the IBM Statistical Package for the Social Sciences (SPSS) 21 was used for data analyses.

**Results:** Multiple regression analysis showed that all dimensions of self-concept were predicting linguistic competencies of hearing impaired children with cochlear implant produced R2= 0.23, F=73.57 and p<0.05 accounted for 23% of the variance.

**Conclusion:** The impaired children with cochlear implant showed the highest score of academic self concept and had highest level of linguistic competencies after controlling for the other factors in the model.

**Key Words:** *Cochlear Implants, Hearing Aid, Hearing Impairment, Self Concept.*

## Introduction

Besides making oral communication more demanding, a hearing loss can also impact upon such varied dimensions of the human life as mental, emotional and physical well being, social skills, self-concept and family relationships. The development and growth of self-concept of people with disability has its own distinctive challenges, especially those with hearing-related issues. Progress related to the effect of deafness has mainly focused on language acquisition and its related influence on cognitive development and academic achievement.[1,2] However, the communicative functions of language, especially their effect on the relationship with one's surroundings and therefore on social effective evolution have not been the focus of research.

There are four dimensions of self concept, namely: academic self-concept, physical self-concept, social self-concept and general self-concept. Ordaz-Villegas and Acle-Tomasini state that "academic self-concept is perception that a student has about his or her own academic abilities, it constitutes one of the most relevant variables in the academic world." Physical self-concept includes such pertinent aspects as physical activity, appearance, health and fitness. The low self-perception about one's physical appearance affects linguistic abilities in the hearing impaired children due to such factors as inferiority complex, fear of not being accepted, nervousness and general anxiety of not being able to conform or appear like others. The social self-concept is developed by one's observations of as well as interactions with others. It is based on one's comparisons with others and one's perceptions of how others view oneself . The general self-concept is the thoughts, feelings and impressions that an individual has about himself or herself. Self-esteem and feelings of competence or adequacy are the two major components of general self-concept.[3,4,5,6]

Factors that appear to influence the self-concept of

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students include: severity or degree of disability, age of onset of disability, acceptance of the disability by parents, type of schooling (regular or special) and special support, labeling, and identification of group adherence.[7,8]

Hearing-impaired (HI) people frequently confront numerous difficulties with respect to their self-concept, such as discourse and dialect delays, correspondence issues, and practically no or limited entrance to the sound-ruled world. These issues can scar HI individuals' level of self-concept leading to such consequences as social embarrassment, tiresomeness and unstable companionship. Today, hard of hearing children who cannot make effective use of traditional listening devices get cochlear implants (CIs), which are able to produce beneficial results for them. Cochlear implants beneficiaries have been found to promote levels of self-concept that are more or less equivalent to those of Normal Hearing (NH) children.[9]

Ample studies are available related to the manner in which deaf children communicate in the family environment, which have been very useful in determining criteria for early intervention and language development with regard to deaf children. However, this is not the case for older children, especially for young students, as the studies provide data on linguistic development in the phonological and syntactic aspects of written and spoken language as well as on the treatment of certain texts (especially narratives). There is practically no material available on the evolution of self concept in relation to the environment and the development of conversational skills, pertinent in developing guidelines for educational intervention. Furthermore, there are only a few studies of social–effective development at the school age that assess the HI children's competence for forming relationships with their hearing peers. Accordingly, it is imperative to examine the effect of deafness both from the way society responds and how the teenagers with listening hindrances react. Self-concept is based on associations and these are based on communication. Children with hearing impairment are more prone to developing lower levels of self-concept. This is on account of their mis-correspondence and the natural social associations that happen outside of their listening bubble. It is likewise identified as to how individuals in their surroundings respond to their listening gadgets and/or the specialized visual techniques used by them.[10,11,12]

Additionally, the manner in which a deaf child positively integrates his or her deafness into his or her self-concept rests on: the quality of communication the child has with his or her surroundings; the social representation of the child's deafness in his or her immediate environment; and the social structure to which he or she belongs.[13]

Similarly, Calderon and Greenberg found that The communication barrier between HI and NH children can function as an obstacle for successful interpersonal relationships and may hamper these children in developing solid social networks.[14]

The main objective of the present study was to find out the impact of hearing loss on the self concept of hearing impaired students and to ascertain the impact of hearing aids and cochlear implants on their self concept.

## Materials and Methods

The study was a descriptive and cross-sectional, having hearing aids and cochlear implants as independent variable, whereas, self concept was the dependent variable. It was conducted in Sir Syed School and College of Special Education, Rawalpindi and Preston University Islamabad Campus with permission from the concerned authority. The data was collected individually from each student which took six weeks i.e. from 12th September 2016 to 21st October 2016, to collect data from hearing impaired students.

The subjects were incapable of giving informed consent so the physician sought that assent by using sign language, lip movements and through written expression in addition to the consent of their parents and legally authorized guardians. The research protocol was submitted for consideration, comment, guidance and approval to the University's research ethics committee before the conduction of study. All procedures performed in the present study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments made in 64th World Medical Association, 2013.

All students had a nonverbal IQ of no less than 80 as well as no other known learning issues. Students

**Table I: Inclusion/Exclusion Criteria**

| S.No | Criteria | Inclusion | Exclusion |
|---|---|---|---|
| 1 | Age/Population | 11-14 years with diagnosed hearing loss | Below 11 and more than 14 years with or without diagnosed hearing loss |
| 2 | Disease | Sensorineural hearing loss Conductive hearing loss, congenital hearing loss | sudden hearing loss, hearing loss due to recent noise or occupational exposure |
| 3 | Language | Instructions given through text both in Urdu and English, lip reading and sign language was also used where required. | Native language |
| 4 | Setting | Studies performed in settings generalizable to primary care and special educational settings | Illiterate deaf persons |
| 5 | Interventions | Screening tests used, available, or feasible in primary care settings, self concept questionnaire, and portable audiometer | Screening tests not used or available in primary care settings and special educational settings |
| 6 | Study Design | Randomized controlled trials and controlled observational studies | Uncontrolled observational studies |

were not included on the off chance that they encountered co morbidities, such as: visual hindrances or Autism Spectrum Disorders. The HI youngsters were incorporated on the off chance that they encountered hearing loss of no less than 40 decibels in the best ear, which was identified prelingually (3 years) or prelingually (3–5 years).

An aggregate of 233 students (Mean age = 11.8 years, SD = 1.7) took an interest in this investigation of which 103 were youngsters using hearing devices (70 using hearing aids and 30 using cochlear implants) and 120 youngsters were used NH controls (hearing impaired without any aiding device). Data was parametric in nature. A modified version of Self-Description Questionnaire III based upon the Shavelson Model of self-concept constructed by Marsh and Shavelson was used, after permission from the author. The modified version assessed three components namely academic self-concept, physical self-concept and social self-concept having 60 items. Fifty percent statements were negatively phrased. The original SDQIII based on 8-point self-rating scale consisted of 136 items, which assessed four areas of academic self-concept, eight areas of nonacademic self-concept, and the area of General-self. All 13 SDQIII areas consisted of 10 or 12 items each, half of which were negatively worded.[15]

Modifications were made in SDQIII to use it in Pakistani institutions. It was translated into Urdu language. Responses were delimitated to 4-point scale and the number of items were reduced to 60. As the study was restricted to three components of self-concept i.e. academic self-concept, physical self-concept and social self-concept, only 6 areas (i.e. Verbal, Academic, Physical Ability, Physical Appearance, Same Sex Peer Relations and Parent Relations) of SDQIII were included in the instrument. Each area consisted of 10 items. Verbal and academic areas were merged to assess academic self-concept, items of physical ability and physical appearance were fused to assess physical self-concept, and items of same sex peer relations and parent relations were combined to assess social self-concept.

The research instrument was validated by three specialists in the field. After pilot-testing, its reliability was determined by calculating the Cronbach's alpha and further improvements were made in its items. Factor analysis was deemed appropriate for the study data, as the value of KMO was 0.724, which is considered as a good value.

Data collected, by using the procedure mentioned above, was sorted and tabulated. Testing of hypotheses entailed a thorough analysis of data by using such statistic as multiple regression and correlation matrix.

The statistics were applied after fulfilling their assumptions regarding their applicability on the data collected. The IBM Statistical Package for the Social Sciences (SPSS) 21 was used for data analyses.

**Procedure**

NH controls were used from primary and secondary schools over Pakistan. A sample representing a complete range of HI children, 10 special schools for the HI were enlisted.

The survey was regulated on LCD. Questions were shown one by one on the screen. Guidelines for all tests were prearranged in the child's preferential method of communication to guarantee that the student understood each item. The HI students could choose between two versions of the questionnaire. The first version was exclusively composed of things, while in the second; everything was displayed in written text with sign language video clip appearing at the top corner of the screen. The talked dialect was interpreted using gesture based communication performed by a qualified mediator. It was ensured that there was a perfect synchronization between all the elements.

Parents or caregivers were requested to complete a questionnaire assessing demographic variables such as net income and level of education. In the HI group, several audio logical variables were derived from the children's medical and audio logical notes after an informed consent was obtained.

**Table II: Characteristics of Hearing Impaired children (N=223)**

| **Total Hearing impaired** | **Hearing impaired (HI) without any aiding device** | **Hearing impaired with Hearing Aid (HA)** | **Hearing impaired with Cochlear Implant (CI)** |
|---|---|---|---|
| Number of children | 120 | 70 | 33 |
| Age mean in years (SD) | 11.2(1.3) | 11.6(1.7) | 11.5(1.9) |
| Gender %<br>Male<br>Female | <br>57 (48%)<br>63 (52%) | <br>36 (51%)<br>34 (49%) | <br>19 (58%)<br>14 (42%) |
| Degree of hearing loss (%)[a]<br>Moderate (40-60dB)<br>Severe (61-90dB)<br>Profound (>90dB) | <br>23 (19%)<br>30 (25%)<br>67 (56%) | <br>29 (41%)<br>24 (34%)<br>17 (24%) | <br>0 (0%)[1]<br>2 (6%)[1]<br>31(94%)[1] |
| Preferred mode of communication (%)[b]<br>Oral language only<br>Sign-supported language | <br>23 (19%)<br>97 (81%) | <br>54 (77%)<br>16 (23%) | <br>20 (61%)<br>13 (39%) |
| Age of onset of hearing loss (%)[c]<br>Pre-lingual (< 3 years)<br>Pre-lingual (3-5 years) | <br>89 (74%)<br>31 (26%) | <br>56 (80%)<br>14 (20%) | <br>24 (73%)<br>09 (27%) |
| Socioeconomic status mean (SD)[d] | 12.1(2.4) | 11.7 (2.3) | 12.1 (2.4) |

Note: All the students were from Special schools meant for hearing impaired children.

a degree of hearing loss was calculated by averaging unaided threshold at 500, 1,000, 2,000 Hz.

b preferred mode of communication scores were calculated by using information from parents

c age of onset of hearing loss was calculated by using medical reports of children.

d Socio-economic status scores were calculated by measuring parental education, and total family income 1**p<.05

**Table III: Correlation Matrix of all Types of Hearing Impaired Students (N = 223)**

Hearing impaired without any Hearing Device (HD) n = 120

| **Dimension** | **ASC** | **PSC** | **SSC** | **GSC** |
|---|---|---|---|---|
| Academic Self-Concept (ASC) | - | | | |
| Physical Self-Concept (PSC) | .28** | - | | |
| Social Self-Concept (SSC) | .25** | .26** | - | |
| General Self-Concept (GSC) | .34** | .33** | .20** | - |
| Hearing impaired with Hearing Aid (HA) n = 70 | | | | |
| **Dimension** | **ASC** | **PSC** | **SSC** | **GSC** |
| Academic Self-Concept (ASC) | - | | | |
| Physical Self-Concept (PSC) | .48** | - | | |
| Social Self-Concept (SSC) | .40** | .49** | - | |
| General Self-Concept (GSC) | .42** | .41** | .46** | - |

| Hearing impaired with Cochlear Implant (CI) n = 33 | | | | |
|---|---|---|---|---|
| **Dimension** | **ASC** | **PSC** | **SSC** | **GSC** |
| Academic Self-Concept (ASC) | - | | | |
| Physical Self-Concept (PSC) | .64** | - | | |
| Social Self-Concept (SSC) | .68** | .63** | - | |
| General Self-Concept (GSC) | .66** | .67** | .65** | - |

**p < .05

## Results

The value of Cronbach's alpha for Academic Self-Concept = 0.83, Physical Self-Concept = 0.79, Social Self-Concept = 0.76 and General Self-Concept = 0.81

According to Table III, a Pearson product-moment correlation coefficient was computed to assess the interrelationship among the dimensions of self-concept for the hearing impaired without any hearing device, hearing impaired with hearing aid and hearing impaired with cochlear implant. This determined the extent of interrelationship among the 4 dimensions of self-concept for each of three categories of students.

With regard to hearing impaired without any hearing device in Table III there was a positive correlation, but a weak uphill relationship between each paired dimension of self-concept. The p-values are less than .05, which show that each dimension of self-concept are correlated with each other: r (118) = .28, p < .05 (academic self-concept and physical self-concept); r (118) = .26, p < .05 (physical self-concept and social self-concept); r (118) = .20, p < .05 (social self-concept and general self-concept); r (118) = .25, p < .05 (social self-concept and academic self-concept); r (118) = .34, p < .05 (general self-concept and academic self-concept); and r (118) = .33, p < .05 (general self-concept and physical self-concept). The results show that there is a significant relationship between each paired dimension of self-concept.

With regard to hearing impaired with hearing aid in Table III, there was a positive correlation, but a weak uphill relationship between each paired dimension of self-concept. The p-values are less than .05, which show that each dimension of self-concept are correlated with each other: r (68) = .48, p < .05 (academic self-concept and physical self-concept); r (68) = .49, p < .05 (physical self-concept and social self-concept); r (68) = .46, p < .05 (social self-concept and general self-concept); r (68) = .40, p < .05 (social self-concept and academic self-concept); r (68) = .42, p < .05 (general self-concept and academic self-concept); and r (68) = .41, p < .05 (general self-concept and physical self-concept). The results show that there is a significant relationship between each paired dimension of self-concept.

With regard to hearing impaired with cochlear implant in Table III, there was a positive correlation, but a moderate uphill correlation between each paired dimension of self-concept. The p-values are less than .05, which show that each dimension of self-concept are correlated with each other: r (31) = .64, p < .05 (academic self-concept and physical self-concept); r (31) = .63, p < .05 (physical self-concept and social self-concept); r (31) = .65, p < .05 (social self-concept and general self-concept); r (31) = .68, p < .05 (social self-concept and academic self-concept); r (31) = .66, p < .05 (general self-concept and academic self-concept having a moderate uphill relationship); and r (31) = .67, p < .05 (general self-concept and physical self-concept). The results show that there is a significant relationship between each paired dimension of self-concept. Results suggest that cochlear implants are most effective in developing hearing impaired children's self-concept.

**Table IV: Regression Analysis of Dimensions of Self Concept for predicting linguistic competencies (N =223)**

| | **Hearing impaired with Hearing Aid (HA)** | | | **Hearing impaired with Cochlear Implant (CI)** | | |
|---|---|---|---|---|---|---|
| | **B** | **SE** | **β** | **B** | **SE** | **β** |
| Constant | 11.71 | 1.37 | | 12.93 | 1.42 | |
| Academic self-concept | .981 | .102 | .886 | 1.92 | .124 | .931 |
| Physical self-concept | .409 | .123 | .402 | .571 | .117 | .621 |
| Social self-concept | .989 | .126 | .921 | .992 | .132 | .921 |
| General self-concept | 2.76 | .131 | .373 | 2.98 | .129 | 3.11 |

$R^2$=.23, F=73.57**

**p<.05

The multiple regression analysis of all dimensions of self-concept in predicting linguistic competencies of hearing impaired children with hearing aid produced R2= 0.23, F=73.57 and p < 0.05 accounted for 23% of the variance. The significance value (p < 0.05) having positive values of B and standardized beta values for academic self-concept (β=0.886), physical self-concept (β=0.402) and social self-concept (β= 0.921) had significant regression weights which showed

unique impact / contribution of all these predictors to the linguistic competencies of hearing impaired children with hearing aid. The social self concept with the highest beta value (β= 0.921) showed the strongest contribution to the linguistic competencies of hearing impaired children with hearing aid. This indicated that the impaired children with hearing aid who showed the highest score of social self-concept demonstrated the highest level of linguistic competencies after controlling for the other factors in the model. The academic self-concept with beta value (β= 0.886) demonstrated moderate contribution in predicting linguistic competencies of hearing impaired children with hearing aid. Whereas, the physical self concept with the lowest beta value (β= 0.402) showed that the contribution of this predictor to the competencies of hearing impaired children with hearing aid was less than other two predictors.

The multiple regression analysis of all dimensions of self-concept in predicting linguistic competencies of hearing impaired children with cochlear implant produced R2= 0.23, F=73.57 and p<0.05 accounted for 23% of the variance. The significance value ($p < 0.05$) having positive values of B and standardized beta values for academic self-concept (β=0.931), physical self-concept (β=0.621) and social self-concept (β= 0.921) had significant regression weights which showed unique impact / contribution of all these predictors to the linguistic competencies of hearing impaired children with cochlear implant. The academic self concept with the highest beta value (β= 0.931) showed the strongest contribution to the linguistic competencies of hearing impaired children with cochlear implant. This indicated that the impaired children with cochlear implant who showed the highest score of academic self concept demonstrated the highest level of linguistic competencies after controlling for the other factors in the model. The social self concept with beta value (β= 0.921) demonstrated moderate contribution in predicting linguistic competencies of hearing impaired children with cochlear implant. Whereas, the physical self concept with the lowest beta value (β= 0.621) showed that the contribution of this predictor towards the competencies of hearing impaired children with cochlear implant was less than other two predictors.

## Discussion

Self-concept is a vital prerequisite for sound psycho-social development and empowers children to manage anxiety and address various challenges. The problems encountered in the study of the self-concepts of normal hearing children have been relatively small when compared to the difficulty met by the investigator in examining the self-concepts of hearing-impaired children whose ability to communicate is greatly impaired. The investigation of the development of the self-concept in the hearing-impaired child has been very limited. The lacks of empirical psychological studies on the effects of deafness on the developing organism have resulted in a polarization of theory and thought. One psychological school postulates that the hearing impaired child develops normally in all behavioral areas, except language acquisition The other adheres to an "altered organism" theory of the hearing-impaired child in which the deaf child is not only physically different from the normal hearing child, but is also emotionally and psychologically different . Hearing impaired students frequently face challenging situations; therefore, it is even more critical for them to have adequate levels of self-concept.

Based on the interrelationship among the dimensions of self-concept, results show that the: hearing impaired children with cochlear implant have a high self-concept; hearing impaired children with hearing aid have a moderate self-concept; and hearing impaired children without any hearing device have a low self-concept. This is because the cochlear implants allow hearing impaired children to have conversations, recognize warning signals as well as understand the sounds in the environment. The hearing aids amplify the sounds in the environment, which can become loud and bothersome and as such cause headache and nausea in hearing impaired children. Furthermore, with hearing aids, there is limited frequency assistance in high range sounds. Also, ear molds and their acoustic feedback issues may be repetitive, time-consuming and aggravating. Therefore, cochlear implants fare better in developing self-concept for promoting linguistic abilities in hearing impaired children than hearing aids.

The result of the present study bear a resemblance to

the result of the study conducted by Silvestre, Ramspott & Pareto which says social self concept has contribution in predicting linguistic competencies of hearing impaired children which consequently results into high self concept. Similarly the results of the present study are in line with the study of Calderon and Greenberg which says that the communication barrier between HI and NH children can function as an obstacle for successful interpersonal relationships and may hamper these children in developing solid social networks.

There is limited research material available on children and especially on the hearing impaired children with regard to the different dimensions of self-concept. Most importantly, no studies have been undertaken to compare the effect of hearing aids versus cochlear implants on the linguistic competencies of young children's academic, physical, social and general self-concept. Therefore, the study will add to a new body of knowledge. The study regarding self concept can be conducted for hearing impaired adults and the population of study can also be disable people of other categories like visually impaired students and physically impaired students with variations in data collection techniques. Clinicians and teachers of hearing impaired students must always be aware of the peril and protective factors related to self-concept in order to help hearing impaired individuals to reach their full potential.

## Conclusion

It can be concluded from the present study that the hearing loss has great on the self concept of hearing impaired students and the students with cochlear implants have better self concept as compare to the students using hearing aids and the students using no assisting technology, which consequently means that self concept is largely effected by the hearing loss and linguistic competencies of students.

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